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ABSTRACT

The purpose of this paper is to: (1) explore some possible explanations for the lack of empirical support of advance organizers; (2) suggest a plan for improving the empirical research on advance organizers; and (3) recommend some further investigations needed in the area of advance organizers. Some explanations for this lack of support are proposed. Among these explanations are: absence of an operational definition of the advance organizer; neglect of the measurement of the cognitive structure of the learners; failure of the tests to detect the facilitative effects of the organizer; failure of the learners to understand or use the organizers to study the learning materials; and use of very lengthily written organizers that might cause a memory strain. A plan is suggested to improve this research. This plan includes: the preparation of operationalized advance and placebo organizers; the experimental design; the sample selection; the implementation of the advance and placebo organizers; test construction and application; and the hypothesis testing and data analysis. Some aptitude interaction studies are recommended which relate the advance organizer to selected learners' attributes, including information processing capacity, learning styles, and Piagetian cognitive levels. (Author/JN)

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Advance Organizer Research: One Step Further

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ABSTRACT

The purpose of this paper is to: 1) explore some possible explanations for the lack of empirical support of advance organizers; 2) suggest a plan for improving the empirical research on advance organizers; 3) recommend some further investigations needed in the area of advance organizers. Some explanations for this lack of support are proposed. Among these explnations are: 1) absence of operational definition of the advance organizer; 2) neglecting the measurement of the cognitive structure of the learners; 3) failure of the tests to detect the facilitative effects of the organizer; 4) failure of the learners to understand or use the organizers to study the learning materials; 5) using very lengthily written organizers that might cause a memory strain. A plan is suggested to improve this research. This plan covers: the preparation of operationalized advance and placebo organizers; the experimental design; the sample selection; the implementaion of the advance and placebo organizers; test construction and application; the hypothesis testing and data analysis. Some aptitude interaction studies are recommended which relate the advance organizer to some of the learners' attributes; the information processing capacity; the learning styles and the Piagetian cognitive levels.

Introduction

Ausubel (1960) has suggested that students should be presented with statements containing an orderly arrangement of highly generalized concepts needed in their cognitive structure before learning new concepts. Ausubel refers to such statements as "Advance Organizers."

For example, before students are taught the circulatory system they could be presented with the following statements (advance organizer):

> The circulatory system is like the sanitary system of a city. In both there is a pumping station, pipelines with varying sized pipes, a filtration plant, and exchange terminal, and capacity of disposal waste. (Eggen, Kauchak, & Harder, 1979, p. 282)

Ausubel (1968) defines advance organizers as "appropriately relevant and inclusive introductory materials...introduced in advance of learning... and presented at a higher level of abstraction, generality and inclusiveness, " (p. 148).

The origin and use of advance organizers are based on Ausubel's subsumption theory (Ausubel, 1962, 1968). According to this theory, cognitive structure is hierarchically organized in terms of highly inclusive concepts under which are subsumed less inclusive concepts and information data. Further, it is assumed that subsequent learned materials are assimilated by a subsumption process, becoming incorporated into previously learned, general ideas stored in the central nervous system. An advance organizer is a subsumer - a learning aid that allows new material to be more readily incorporated into the existing cognitive structure. The organizer can then provide a nucleus around which the new material may be subsumed (Jones, 1977).

According to Ausubel, Novak and Hanesian (1978), advance organizers probably facilitate the incorporability and longevity of meaningful verbal materials in three different ways: "First, they explicitly draw upon and mobilize what-

ever relevant anchoring concepts are already established in the learners' cognitive structure and make them part of the subsuming entity...second, advance organizers at an appropriate level of inclusiveness...provide optimal anchorage. This promotes both initial learning and later resistance to obliterative subsumption. Third, the use of advance organizers renders unnecessary much of the rote memorization to which students often resort becuase they are required to learn the details of an unfamiliar discipline before having available a sufficient number of key anchoring ideas," (p. 276).

A rather common contention is that advance organizers seem to have a sound theoretical basis, and should facilitate learning and retention: Has the empirical research supported this contention?

What Research Says About the Advance Organizers

Since 1960, there have been hundreds of studies examining effects of advance organizers, and dozens of reviews (Mayer, 1979a). In this paper only the reviews of Barnes and Clawson (1975); Hartley and Davis (1976); Baker (1977); Kozlow (1978); Singleton (1979); Mayer (1979a); and Luiten, Ames, and Ackerson (1980) are examined.

Barnes and Clawson (1975) reviewed 32 advance organizer studies, including those by Ausubel and colleagues, and found only 12 that showed significant results in favor of the use of the advance organizers. Barnes and Clawson concluded that "advance organizers as presently constructed, generally do not facilitate learning," (p. 651). However, this review of Barnes and Clawson has been criticized as being unrepresentative of all reserach on advance organizers (Ausubel, 1978; Mayer, 1979b).

In their review of reserach on advance organizers, Hartley and Davis (1976) found that in the majority of the studies reviewed the advance organizer appears

to facilitate both learning and retention.

Baker (1977) examined 52 studies including the early work of Ausubel. He found that most of the studies failed to support the positive effect of advance organizers on learning and retention.

Ninety-nine experimental studies were analyzed by Kozlow (1978). The following are some findings and conclusions of this analysis:

1) Of the 99 t-statistics computed for the experimental and control groups, 68 were positive indicating that the achievement means for advance organizer groups were higher than those for the control groups. Only 22 of these positive t-statistics were statistically significant, while none of the 29 negative t-statistics were significant.

2) Some significant findings in favor of the advance organizers may have been due to the possible contribution of advance organizers alone to answering the text questions or to the inequality of study time for the treatment groups.

3) Students' inability to understand the advance organizer may account for some of the non-significant results.

4) Advance organizers are probably more likely to show facilitative effect when their reading level is appropriate to a grade level, when the rate of introduction of new ideas is slower, when the content is less complex, and when students are given more time to process the advance organizers.

5) Comparative organizers are more effective than the expository organizers.

6) Advance organizers are more effective with higher grade levels.

Singleton (1979) reviewed 49 advance organizer studies. Twenty one studies produced significant results, while the other 28 studies did not.

Mayer (1979a) analyzed 44 published research studies. Twenty-seven studies

included an advance organizer vs. a control group and 17 studies included an advance organizer group vs. a post organizer group. Results of these studies were compared to some predictions drawn from the assimilation theory (Mayer, 1979b). Among the conclusions of Mayer's review are:

1. Advance organizers have a positive but small effect on learning and retention. However, this effect is less likely when the learning materials are familiar, when the learners are experienced, when the advance organizer does not provide an assimilative context for the materials, or when the test fails to measure transfer of learning.

2. When advance organizers are compared to post organizers, the latter seem to be less effective with regard to facilitation of learning.

3. Advance organizers have a stronger effect on learning with poorly integrated materials rather than with well-organized or spiral format materials.

4. Advance organizers are more helpful for inexperienced learners rather than those possessing a rich set of subsuming knowledge (pre-requisite knowledge).

5. Advance organizers have a special effect on measures of transfer of learning more than specific retention of details.

The review by Luiten et. al. (1980) contains perhaps the most interesting summary of past reserach. Using meta analysis techniques they investigated approximately 135 published and unpublished studies, covering the period from 1960 to 1979. Some conclusions of this meta analysis study follows:

1. The advance organizers have a small but facilitative effect on learning and retention.

2. The advance organizers seem to have a long term effect on learning rather than a short term (warm-up) effect. The effect of advance organizers seems to increase with time.

3. Advance organizers seem to be effective with individuals of all ability levels and most effective with high ability individuals.

4. The aural mode of advance organizers is more effective than the written one.

A general look at the above reviews reveals a discrepancy in the literature with regard to the facilitative effects of the advance organizer on learning and retention. This look may also reveal that the advance organizer research has failed for the most part to provide overwhelming evidence of this facilitative effect. The advance organizer reserach has suffered from some methodological limitations as well as misconstruing the nature of advance organizers (Ausubel, 1978; Clark & Bean, 1982, Searls, 1980; Weil & Murphy, 1982).

Purpose

The purpose of this paper is to:

1. Explore some possible explanations for the lack of empirical support of advance organizers.

2. Suggest a plan for improving the empirical reserach on advance organizers.

3. Recommend some further investigations needed in the area of advance organizers.

Why did advance organizer research fail?

There have been different explanations presented in the literature that might explain the failure of advance organizer research (c.f., Ausubel, 1978; Kozlow, 1978; Mayer, 1979b). Some of the explanations are:

1. An operational definition does not exist. Unfortunately, it is still not possible to offer a fool-proof definition of the advance organizer (Mayer, 1979a). Consequently, "most of the research seems confused...it is now recog-

nized that there is currently no acceptable way of generating or recognizing advance organizers. This uncertainty has led at least one reseracher to complain, "If it works, it's an advance organizer; if it doesn't work, it isn't!" (Hartley & Davis, 1976, p. 256). In defense of this criticism, Ausubel (Ausubel et al., 1978, p. 175) replied that he devoted 23 pages of his 1968 publication to the nature and definition of advance organizers including a discussion of how to construct one on a specific topic. Still, "Ausubel's definitions of advance organizers are logical rather than operational. They explain conceptually what advance organizers are, but do not specify precisely how they are to be constructed." (Clark & Bean, 1982, p. 5).

2. Lack of attention to both the cognitive structure of the learners and the new concepts to be learned. In his discussion concerning the methodological limitations of the studies reviewed by Barnes and Clawson (1975), Ausubel (1978) indicated that some of these studies did not attempt any systematic appraisal of already available relevant concepts (subsumers) in the cognitive structure of the learners. In the mean time no efforts were made in these studies to analyze the new concepts included in the learning materials. This lack of attention to both the cognitive structure and the new concepts to be learned may result in building an ineffective advance organizer.

In essence, the advance organizers seem to be less effective when the subjects possess the subsumers in their cognitive structure and when the learning material is familiar (See the above review of Mayer, 1979a).

3. Failure of previous studies to analyze results in terms of what kind of learning takes place. Most previous studies used achievement tests that measured the overall amount of information retained. Ausubel's subsumption theory predicts that the retention of the major concepts or ideas will be enhanced by the use of

advance organizers but the retention of technical details or facts will not (Searls, 1980). So, the tests that measure the overall achievement or the technical details will not be sensitive to the selective effects of advance organizers.

4. Failure to test for retention beyond a few days. Most previous studies used the immediate tests and/or retention test conducted after a short period of instruction. The positive effect of the organizers might not be detected with these tests. Ausubel (1978) indicated that tests of application of concepts adminstered six weeks or more after instruction, are more likely to show the positive effect of advance organizers. Luiten et al. (1980) found that the positive effect of advance organizers increases with time. This would seem to indicate a permanent advantage stemming from the advance organizers' treatment rather than a short term "warm-up" effect.

5. The subjects might not have understood the advance organizer. Kozlow (1978, p. 146) indicated that if the students were unable to understand advance organizer information, there would be no opportunity for subsumers to be established in their cognitive structure. So, the advance organizers will have no facilitating effect on learning or retention.

6. The advance organizer might not have included the appropriate subsumers. The advance organizer functions properly when it includes the appropriate subsumers or concepts needed for understanding the new learning materials. Failure of some previous studies to meet such a condition might have resulted in non-significant findings (Kozlow, 1978, p. 146).

7. The advance organizer might not have been attended to or used. Learners who are not instructed about the use of advance organizers may not properly execute them. Consequently, they may fail to readily incorporate the new ideas

found in the learning material into their cognitive structure (Noel, Bongjoh, & Youngy 1980).

8. The advance organizers are too lengthy for the students to retain them in memory while they subsume the new learning materials. In most previous studies the advance organizers were rather lengthy (about 500 words) as were the related learning materials (approximately 2,000 words). These lengthy organizers could have caused memory strain since the learners needed to retain in memory a 500 word organizer while attempting to subsume 2,000 words of learning materials. This memory strain could be crucial if students are given a short time to study the advance organizer and/or the learning materials.

The above explanation (#8) is supported by the following evidences:

a. The capacity of human memory to process information is rather limited (Craik & Lockhart, 1972).

b. Very short advance organizers, one sentence statements, interspersed in the learning materials were found to be more effective than "en masse" or "whole" lengthy organizers (Chaudhari & Buddhisager, 1981; Rickards, 1975; Rickards & McCormick, 1977).

c. The length of advance organizers was found to be negatively related to its effect on learning (Kozlow, 1978).

In addition to the above eight explanations, the failure of advance organizer research could be due to some other methodological problems. This research has not always met the required conditions for experimental studies including random assignment of subjects to treatment groups, maintaining independence of subjects, using the appropriate statistical tests, pretesting the subjects on learning materials, and following established procedures for test construction (Barnes & Clawson, 1975; Weil & Murphy, 1982).

A plan is suggested in this paper to improve advance organizer reserach. This plan is based on the above discussion of the theoretical basis of advance organizers, the findings of previous reviews and the explanations proposed for the failure of advance organizer reserach. This plan covers the following seven stages of advance organizer's studies:

1. The preparation of operationalized advance organizers
2. The preparation of placebo organizers
3. The experimental design
4. The sample selection
5. The implementation of the advance and placebo organizers
6. Test construction and application
7. Hypothesis testing and data analysis

Stage 1: The Preparation of Operationalized Advance Organizers

Zeitoun (Note 2) has proposed a new procedure that can be utilized by researchers to construct advance organizers. This procedure is called the Procedure of Operationalizing Advance Organizers (POOAO). This procedure encompasses the following eight steps (Figure 1):

1. Analyzing the learning materials
2. Mapping the cognitive structure of the learners
3. Determining the characteristics of the advance organizer
4. Estimating the readability of the advance organizer
5. Checking the understandability of the advance organizer
6. Assessing the study time of the advance organizer
7. Valuing the validity of the advance organizer
8. Revising the advance organizer

Insert Figure 1 about here

Step 1: Analysis of Learning Materials

The learning materials are the passages or lessons to be learned. These materials are usually preceeded by the advance organizer.

The purpose of analysis of these materials proceeds in the following three substeps (figure 2):

a. Determining the organization of the materials. Learning materials should preferably be disregarded if they contain built-in organizers and proceed deductively, i.e., proceed from regions of lower to greater differentiation (higher to lower inclusiveness). Much of the potential benefit derivable from advance organizers will not be actualized with such materials (Ausubel et al., 1978, p. 172).

b. Assessing the familiarity of the materials. Preferably, learning materials that are very familiar should be excluded. Mayer (1979a) found that the organizers seem to be less effective with such types of materials.

The researcher could assess familiarity of the materials by using some techniques such as interviews, questionares (Singleton, 1979), and achievement test (Ausubel, 1960). This assessment is preferably conducted on a random sample drawn from the target population. Also, the researcher may consider the opinions of the teachers concerning the familiarity of the materials.

c. Extracting the major ideas (the subsumers) contained in the materials. Major ideas are in the form of superordinate concepts, principles (generalizations) and conceptual schemes that are contained in the learning materials.

One approach that might help to extract the major ideas from the learning materials is to construct a "concept map" (Novak et al., 1981; Stewart, Van Kirk, and Rowell, 1979). The concept map is a pyramid or tree-type diagram which shows the relationships among the ideas and also shows which ideas are

subsumed by others. It should be possible to identify superordinate ideas which subsume the entire structure. These superordinate ideas are the "subsumers" of all information included in the learning materials.

Insert Figure 2 about here

Step 2: Mapping the Cognitive Structure of the Learners.

By cognitive structure, Ausubel means a person's knowledge of a particular subject matter at any given time and how well organized, clear and statable it is (Ausubel, 1963, p. 27). In other words, cognitive structure has to do with what kind of prior knowledge of a field is in our minds; how much of it there is; and how well it is organized (Weil & Joyce, 1978, p. 202).

Mayer (1979a) indicated that the advance organizers are likely to be more effective when they contain "subsumers" that are not part of the cognitive structure of the learners. Accordingly, the researcher needs to map the cognitive structure of those learners to establish presence or absence of these subsumers.

This mapping could also be conducted on the same random sample used previously to determine the familiarity of the learning materials (see step 1,b).

There are many different techniques that have been used to map the cognitive structure. Some of these techniques are 1) clinical interviews; 2) concept map line labeling task; 3) tree construction line labeling task; 4) concept relation task; and 5) sentence generation task. More details about these techniques are available elsewhere (e.g., Stewart, 1980).

Preferably, learners who possess the subsumers should be disregarded (Lawton & Wanska, 1977).

It must be noted that mapping cognitive structure should be restricted to the subsumers only. Therefore pretesting subjects on all information included

in the learning material does not constitute an appropriate test of whether or not the subject possess the subsumers. (For more details see: Kozolow, 1978).

Step 3: Determining the Characteristics of Advance Organizers.

To determine the characteristics of the advance organizer, the researcher needs to consider the feedback available from the above two steps, and the learner attributes (e.g., age, group, grade level, developmental levels, general ability).

There are four characteristics of the advance organizers that the researcher should be specific about: 1) type; 2) length and position; 3) degree of abstractness; and 4) format.

a) Type (expository or comparative organizers). Ausubel (1978) describes two different types of advance organizers - one to be employed when the new material is completely novel, and the other when it is somewhat familiar. The first is termed as "expository organizer" since it presents a description of exposition of the relevant concepts (subsumers). The second is called a "comparative organizer" since it is likely to make use of similarities and differences between the new ideas included in the learning materials and the related ones in the cognitive structure of the learners.

Operationally, the content of the expository organizer is built around the major ideas (subsumers) extracted previously from the learning material (see step 1, c). An example of an expository organizer is:

> The word 'pollution' can be defined as the poisoning of the environment. When our air and water become impure or contaminated man and his environment can be harmed. A polluted environment can poison humans. The ocean and other bodies of water are also threatened. (Singleton, 1979, p. 120.)

As the above example shows, the major idea (e.g., concept of pollution) must be presented in familiar terms and illustrated further with examples (see also: Ausubel et al., 1978, p. 173). Other examples of expository organizers can be

found in the books of Eggen et al. (1979) and Novak (1979).

On the other hand, the comparative organizer is normally constructed in the form of analogies. These analogies relate the major new ideas of the learning materials to familiar ideas existing in the cognitive structure of the learners. An example of a comparative organizer follows:

> An electrical system can be compared to our water system. Water flows through the pipes of a water system. Electricity can be considered as "flowing" through the wires of an electrical system. Wire is the pipe that electricity "flows" through. Volts is the term for electrical pressure. Milliampers is the term for electrical "volume." (Gentner & Gentner, 1982, pp. 15-16)

Of course, the comparative organizer will be effective if the analogies utilized are well constructed. Details about constructing analogies can be found elsewhere (e.g., Gentner, 1980; Gentner & Gentner, 1982).

Comparative organizers could also present differences as will as similarities between old ideas possessed by the learners and new ideas to be learned. (For more details see Ausubel and Fitzgerald, 1961).

The decision of the researchers to use the expository or comparative organizer is based on the familiarity of the learning materials. Expository organizers are preferably chosen when the material is unfamiliar and when the learners have few related subsumers in their cognitive structure. If the material is somewhat familiar and can be related to other ideas possessed by the learners, the advance organizer should be comparative in nature.

b) Length and Position (en masse and lengthy vs. interspersed and short organizer). As indicated before, the en masse lengthy organizers (about 500 words) may cause memory strain. This strain is probably minimized when the interspersed short organizers are utilized.

The decision of the researchers to use the en masse lengthy organizer or the interspersed short organizer is based primarily on his knowledge of the

information processing capacity of the learners. See Furukawa (1977) for more details about this capacity. The en masse lengthy orgnaizers may be more effective with subjects who are high in this capacity, while the interspersed short organizers works better for those who are low in this capacity.

c) Abstractness (concrete - abstract). The decision to use concret organizers or abstract organizers depends on the cognitive developmental stages as explained by Piaget (Inhelder and Piaget, 1958). In general, learners who are in the concrete operational stage may benefit more if presented with concrete organizers. On the other hand, abstract organizers seem to be more effective with those in the formal operational stage. Details about measuring these cognitive stages are available elsewhere (e.g., Lawson, 1978).

Ausubel (1968, p. 335) recommended that advance organizers intended for elementary school pupils should be presented at a lower level of abstraction and should make extensive use of concrete empirical props. See Jone (Note 1) for more details about constructing the concrete and abstract organizers.

d) Format (written - non-written). The selection of advance organizers' format is based on variables such as reading ability of the learners and the mode of presenting the advance organizer.

In general, the written format (prose - passage) is normally utilized when the learners are good readers and when the mode of presentation is reading. Otherwise, the non-written format is utilized. The non-written format includes teacher oral introduction; audio cassette, television and slide presentations; manipulative materials; demonstrations; models; graphs; flowcharts; diagrams; and field trips among others.

Step 4: Estimating the Readability of the Advance Organizers.

This step is desirably executed if lengthily written organizers are utilized.

Fry readability formula (Fry, 1977) is one of the best techniques that can be used to estimate this readability. The organizer seems to be more effective as its readability level approaches the grade level of the subjects (Kozlow, 1978).

Step 5: Checking the Understandability of the Advance Organizer.

A simple procedure to check the understandability of an organizer is to study the reactions of a random sample of subjects given that organizer. At a more sophisticated level of methodology, the investigator may look for the difference in performance between two random samples; one is given the advance organizer, the other is not. This performance is measured by the mean score of a posttest. This test includes questions related to information contained in the advance organizer only. These questions should not cover any information in the learning material (Ausubel, 1960). Moreover, these questions should measure the ability of the subjects to comprehend rather than to memorize the organizer. See Anderson (1972) for more details about the assessment of comprehension ability.

Step 6: Assessing the Study Time of the Advance Organizer.

Kozlow (1978) found that the effect of advance organizers increase as the learners are allowed enough time to study it. A simple method to estimate the study time is to present the organizer to a random sample. Then the time taken by each subject to study the organizer is recorded. The average time could be considered the "study time." It must be noted that the time taken by each subject is calculated from the moment the advance organizer is presented to him until he reports that he understands it. This method is similar to that being used in educational measurement to estimate test time.

Needless to say, the researcher can use the same random sample to execute simaltaneously some of the above steps. This sample should be disregarded because it may contaminate the findings.

Step 7: Valuing the Validity of the Advance Organizers.

The advance organizer is valid if it contains subsumers (major ideas) that match the basic ideas of the learning material.

This validity is desirably determined by a panel of judges or experts (Ausubel, 1978). Both the organizer and learning material should be given to those judges. The percentage of agreement among the judges reflect the degree of validity of the organizer.

Step 8: Revising the Advance Organizer.

The researcher may need to revise the advance organizer in the light of the feedback he obtained from the above steps.

Stage 2: The Preparation of the Placebo Effect

The placebo organizer is the introductory material presented to the control group to minimize the "placebo effect." The placebo effect is the tendency of the subjects in the experimental group to believe in the effectiveness of the treatment simply because it is presented in an apparently scientific setting.

The placebo organizer should meet the following criteria:

1. It should not contain any subsumers that could be used to anchor information in the learning material.

2. It is rather similar to the advance organizer with regard to: a) Length in words; b) position; c) degree of abstractness; d) format; e) readability; f) understandability; and g) study time.

The same procedures used with the advance organizer to determine its readability, understandability, and study time could be utilized with the placebo organizer.

Also, the judges employed to determine the validity of the advance organizer

could be used to prove that the placebo organizer does not include any subsumers related to the learning materials. It must be noted that the placebo organizer should be related to the learning materials and should not distract the attention of the subjects to study this material. Placebo organizers could function in the form of historical introduction (See: Ausubel, 1960). Examples of placebo organizers can also be found in the publication of Novak (1977, pp. 274-276) and Singleton (1979, pp. 130-136), among others.

Stage 3: The Experimental Design.

There are many different experimental designs that could be utilized in advance organizer research. Only a few of the common designs are mentioned below. A detailed review of the experimental designs are available in the publications of Campbell and Stanley (1963); and Huck, Canier, and Bounds (1974) among others. In essence, the purpose of the research is a major determinant in the process of selecting the design.

The common purpose of advance organizer research has been to study the facilitative effect of the organizer on the immediate achievement of the learning materials. There are many designs that could be utilized to meet this major purpose. The basic of these designs are: 1) randomized posttest-only control group design; 2) randomized pretest-posttest control group design; 3) the Solomon four group design; and 4) nonequivalent control group design. The first three designs are normally utilized when the complete randomization of the subjects into treatments, i.e., advance organizer vs. placebo organizer, is possible. The last design is recommended when this randomization is impossible. For example, in some school settings the researcher may not be allowed to assign students randomly. In this case, the researcher can assign the class randomly into the treatments. Design #4 is recommended in this case.

Each one of the four designs has its own advantages and limitations. Still,

the Solomon four group design is probably the best. More details about these designs are available elsewhere (e.g., Campbell & Stanley, 1963; Huck et al., 1974).

In other studies, researchers are interested in exploring the immediate effect of the organizer on learning as well as the long term effect (retention effect). The repeated measure design (Lindquest Type I) is appropriate for these studies (Huck et al., 1974, pp. 105-117).

The above five designs are only appropriate for studies with one independent variable (e.g., advance organizer vs. placebo organizer). If other independent factors are included, multifactor designs are normally utilized. These independent factors could be manipulated and/or organismic (Huck et al., 1974, pp. 180-181). Examples of manipulated factors are: the format of the organizer (written vs. non-written), the length of the organizer (long vs. short), the mode of presenting the organizer (reading vs. teacher presentation), and the degree of abstractness of the organizer (abstract vs. concrete). Examples of organismic factors are sex, I.Q. (high - low), Piagetian cognitive levels (concrete operational - formal operational), and reading ability (high - low).

In fact, the multifactor designs consist of many other designs. The basic of these designs are: 1) completely randomized designs; 2) mixed designs; 3) multifactor repeated measure designs; 4) hierarchical designs; 5) latin square designs, and 6) multifactor analysis of covariance design.

The details of using the multifactor design cannot be taught or even illustrated here. Basic aspects of these designs are presented by Mayers (1979), Huck et al. (1974), and Winer (1971), among others.

If the study includes more than one dependent variable, different designs, multivariate designs, could be utilized (Finne and Matteson, 1978). An example

is a study to determine the effect of an advance organizer on both science achievement and scientific attitudes.

Needless to say, the design of the study is related to its validity. A good design will minimize the effect of some of the extraneous variables that endanger both the internal and external validity. Details about controlling these variables are made available by Campbell and Stanley (1963); Huck (1974); Bracht and Glass (1968); Snow (1974); Sax (1979); and Barber (1973), among others.

Another variable that might need special control is the ability to learn from unfamiliar materials. This variable could have some effect on the validity of results, especially when the learning material is highly unfamiliar and when the complete randomization is lacking. This variable should be distributed rather equally between the experimental and control groups. Ausubel (1960) provided a good methodology to test for this equality. He suggested that a learning material of comparable familiarity is given to both the control and experimental groups. This is to be followed by an achievement test on this material. If the difference on the mean score between these two groups is small and nonsignificant, the researcher may assume that his variable is distributed equally between these groups.

It must be noted that the researcher may add another control group; the blank group, to his study design. This group will be given the learning materials but no advance or placebo organizer. Subjects of the blank group will have the same total time to study the learning materials that it takes the advance organizer group to study the organizer and the learning materials There is some dispute in the literature about adding a blank group to the advance organizer studies. Faw and Waller (1976) argued that adding this group could reveal that giving the learners additional

time to study the learning materials is more effective than giving them that time to study the organizer. Ausubel (1978) refuted the argument. He indicated that it is implausible to suppose that this additional time taken by the blank group will facilitate learning and retention as much as an organizer.

Stage 4: The Sample Selection.

Little can be said here about the sample selection. The researcher may need to consult some references in educational research (e.g., Fox 1969; Sax 1979). It is recommended that the sample be selected randomly and represent the target population. It is also recommended that sample size be determined by using the power analysis technique (Cohen, 1979; Friedman, 1982). Moreover, this technique could be utilized in planning and interpreting the findings. (See: Clark, 1977; Cohen, 1973, for more details.)

Stage 5: The Implementation of the Advance and Placebo Organizers.

The following recommendations are suggested for implementing the advance and placebo organizers:

1. Both the experimental group (advance organizer group) and the control group (placebo organizer group) are separately given an equal amount of preliminary session time. In this session, subjects of the experimental group will be presented the advance organizer along with a verbal explanation of what it can accomplish, and directions for how to use it in studying the learning materials. Additionally, other kinds of advance organizers the subjectd may be familiar with will be briefly discussed.

The rationale for the explanation and directions presented with the advance organizer is that students who are unfamiliar with the use of the advance organizers may not properly execute these organizers resulting in a failure to readily incorporate new ideas into their cognitive structure (Noel et al., 1980; Satterly & Telfer, 1979).

On the other hand, the control group will be instructed rather differently. In this preliminary session, the subjects will be given the placebo organizer, then they will be told this organizer is related to the learning material. They will also be informed that this organizer will increase their knowledge about the learning material, and they need to study it carefully.

The researcher should try to raise the same level of interest in both the experimental and control groups to study the advance organizer and placebo organizer respectively.

2. Both the experimental and control group should be given the same study time to understand the advance and placebo organizer respectively. This study time is assessed in advance (See stage 1, step 6).

3. In case of the use of the non-reading format of the advance organizer, the teaching of learning materials may follow the Ausubel model of instruction as best described by Eggen et al. (1979); and Weil and Joyce (1978). An example of non-reading format is presentation by the teacher.

4. Both the experimental and control group should be separately observed. The purpose of this observation is to check that both groups receive their own experimental protocol. See Snow (1974) for more details about the importance of this observation.

A systematic observation instrument could be constructed for this purpose. (For more details see: Medley & Mitzel, 1963; Ober, Benthly and Miller, 1971)

5. The duration of implementing both the advance and placebo organizers should perhaps be extended for more than a few hours or days. This duration should increase the validity of the results (Singleton, 1979; Snow, 1974).

Stage 6: Test Construction and Application.

The following recommendations are suggested for test construction and ap-

plication:

1. It should be required that the tests used in advance organizer research do not include any questions that are answerable by the information included in the advance organizer (Ausubel, 1978) or the placebo organizer. This requirement could be checked simply by a panel of judges given the advance and placebo organizers; and the tests.

At a more sophisticated level of methodology, the organizer alone should be given to a random sample drawn from the target population. This is to be followed by taking the tests. (For more details see Ausubel, 1960.)

2. Researchers should follow the established procedure for the construction of tests (see: Sax, 1979, Chapter 9). Test items might be constructed according to the technique developed by Lucas and McConkie (1980). Moreover, only tests with a respectable degree of validity/reliability should be utilized.

3. Preferably, measures of immediate learning and retention are of two types, recognition tests, e.g., multiple choice, and recall tests, e.g., short answers (Singleton, 1979, p. 56).

4. Tests should measure for understanding. Guidelines for constructing such tests are made available by Anderson (1972) and Ebel (1982), among others.

5. Preferably, delayed posttests should be conducted approximately six weeks after instruction (Ausubel, 1978).

Stage 7: Hypothesis Testing and Data Analysis.

The following recommendations are suggested for the stage of hypothesis testing and data analysis:

1. Hypothesis testing preferably follows the new procedure developed by Myers and Pohlmann (1979). Some other related new thoughts also need to be considered (See: Carver, 1978; Daniel, 1977; Shaver, 1980).

2. The significance level of testing hypothesis (α) should be determined prior to collecting the data. The justification of this prior significance level has been given in the article of Shine (1980). Furthermore, the .05 level of significance is acceptable (Cowles & Davis, 1982).

3. The selection of an appropriate statistical procedure is dependent on the nature of the independent and dependent factors, as well as the design of the study. The researcher could follow the guidelines suggested by Wolf (1974), and Tatsuoka and Tiedeman (1963, pp. 142-170) to select the procedure suited for his study. It is also recommended that the researcher consult the following references: Huck et. al. (1974), Lee (1975), Mayers (1979) and Winer (1971). The researcher may need to review some related articles for the same purpose. Examples of helpful articles that are related to some designs are by Linn and Slinde (1977); Hendrix, Melvin, and Hintze (1978); Huck and Sandlers (1973); Morrow and Frankiewicz (1979); Herron, Luce, and Neie (1976); and Kagan and Lindman (1980).

4. The researcher should be aware of the assumptions of the statistical procedure to be used (Myers and Pohlmann, 1979). Unless the procedure is robust to some assumptions, all the assumptions might not be violated.

5. If the statistical analysis shows that there is a significant difference between the experimental group and control group much pondering remains to be done. The detection of a statistically significant difference, in and of itself, is nothing to crow about (Carver, 1978). The difference between groups must meet two criteria in order to be judged educationally important. They must not only be statistically significant, but practically significant as well (Daniel, 1977; Wolf, 1974). For example, Ausubel (1960) found a significant difference between the mean score of the advance organizer group and

the control group in favor of the first group. However, this difference was 2.6 (the maximum score on the test used was 36). This difference is quite small and could not be practically significant. With this small difference, one could not recommend using the advance organizer strategy in schools.

There are many other sophisticated techniques that should be used to determine the practical significance of the differences obtained (see: Gaito and Firth, 1973; Good and Fletcher, 1981; Hasse, Weachter and Solomon, 1982; Wolf, 1974).

5. If the statistical analysis shows that there is no statistical difference between the mean scores of the advance and placebo organizer groups, the researcher might not jump to the conclusion that the advance organizer strategy does not facilitate learning and/or retention. He might first need to consider how large this difference is; the sample size and selection; and how much control existed in his study. When this difference is large and in favor of advance organizer group, the sample large and randomly selected, and the study well controlled, the researcher could draw another conclusion. This being that a difference exists in favor of the advance organizer group, but the evidence (statistical) is not strong enough to attribute this difference to anything other than chance (see related discussion offered by Neie, 1974).

According to the above argument, it is recommended that the descriptive statistics (e.g., mean and standard deviations) should be utilized in hypothesis testing (Carver, 1978).

Recommendations For Further Reserach

On the basis of some ideas presented previously in this study, the following aptitude interaction studies are recommended:

1. Studies that address the question of the comparable effect

of whole, lengthy organizers vs. interspersed and short organizers on the immediate learning and retention. Few studies have reported results related to this question (e.g., Rickards, 1975; Rickards & McCormick, 1977). These results show that the interspersed and short organizers are more effective than the whole, lengthy ones. Future research should take into consideration some related variables; namely the cognitive processing capacity as explained by Furukawa (1977), and information density in the learning material (Aiken, Thomas & Shennum, 1975). It is predicted that the treatment (whole and lengthy organizers vs. short and interspersed organizers) will interact with these two variables. This prediction has not been yet verified empirically.

2. Studies that investigate the Piagetian cognitive levels of students (Inhelder and Piagetian, 1958) as related to concrete organizers vs. abstract organizers. In fact there have been few studies that attempt to relate Ausubel's advance organizer paradigm with Piaget's theory (Searls, 1980).

3. Studies that relate advance organizers to learning styles, namely, the serialistic vs. holistic styles. According to Pask (1975, p. 53), serialists learn, remember, and recapitulate subject matter in terms of successive cognitive structure in which concepts are related to simple concept relations (lower order relations). Holists on the other hand, learn, remember and recapitulate information as a whole and simultaneously make a connection between concepts. This is one of the higher order relations. Typical for the learning style of serialists is the combination of information in a linear sequence and not working simultaneously on complexity of information. Obviously, these two learning styles seem to be related to subsumption processes as explained by Ausubel (1962). One can then predict that advance organizers will be more effective for holists rather than serialists. This prediction needs empirical verification.

Conclusion

Research has failed to provide overwhelming evidence that advance organizers enhance meaningful learning and retention. "The dictum from the nature of science should be kept in mind: Absence of evidence does not necessarily imply evidence of absence," (Searls, 1980, pp. 19-20). In this connection, Ausubel (1980) confirmed:

> It is almost inevitable...that the advance organizers will induce no positive effects on meaningful learning if they do not conform either to the essential criteria for designing genuine organizers or to adequate methodological criteria for conducting organizer research (p. 403).

It is believed that the overwhelming supporting evidence being sought can be found. First, a number of methodological refinements seem necessary in order to develop well designed studies. Second, some propositions from other paradigms could be incorporated into advance organizer research. Basic to these paradigms are Piaget's theory, and the information processing models. Finally, we ought to know that the advance organizer strategy is not a panacea. Ausubel never claimed it to be so. This strategy is appropriate for some learners and learning materials. The endeavor should be devoted to defining those learners and materials.

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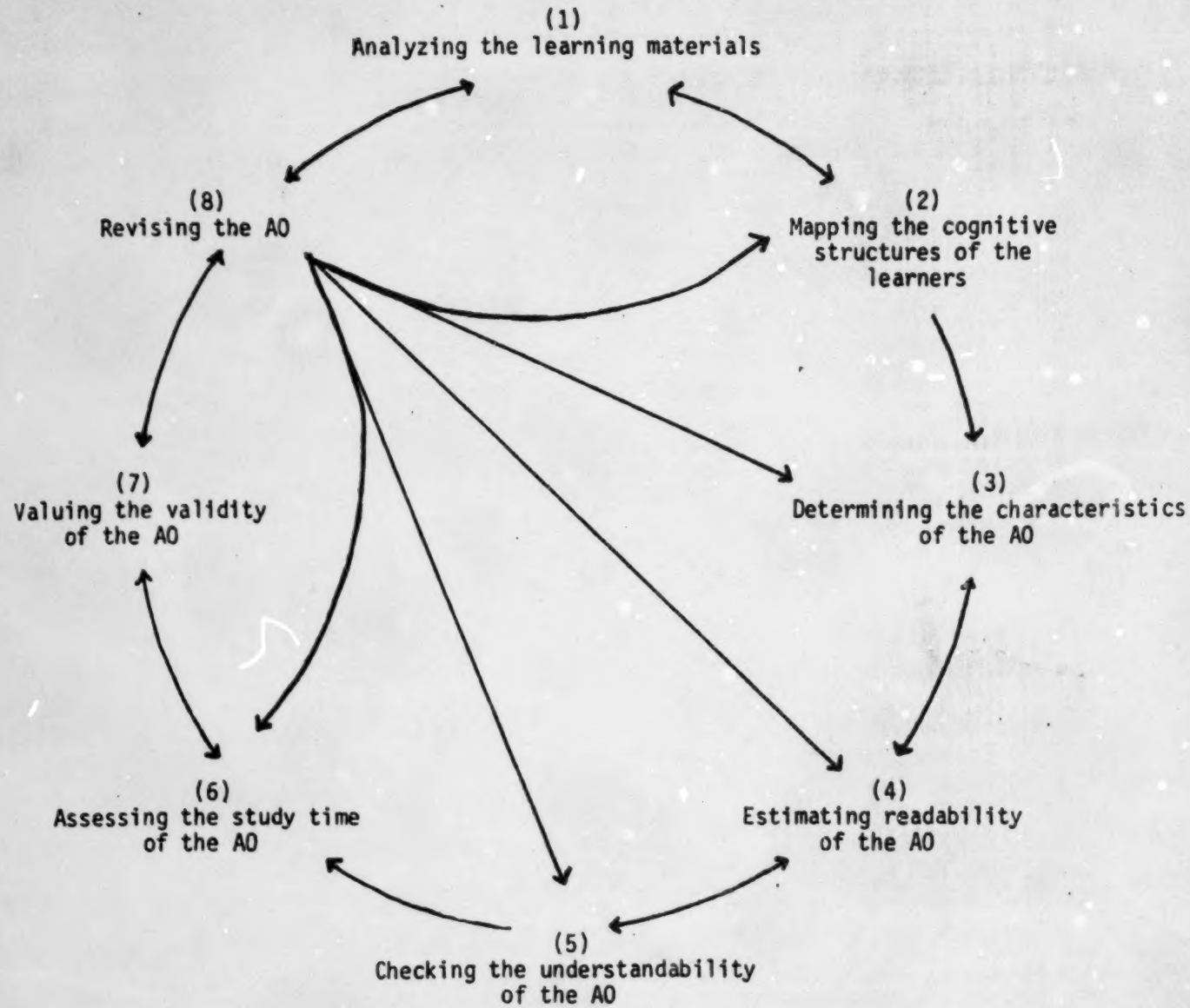

Figure 1: Steps of constructing the advance organizer (AO).

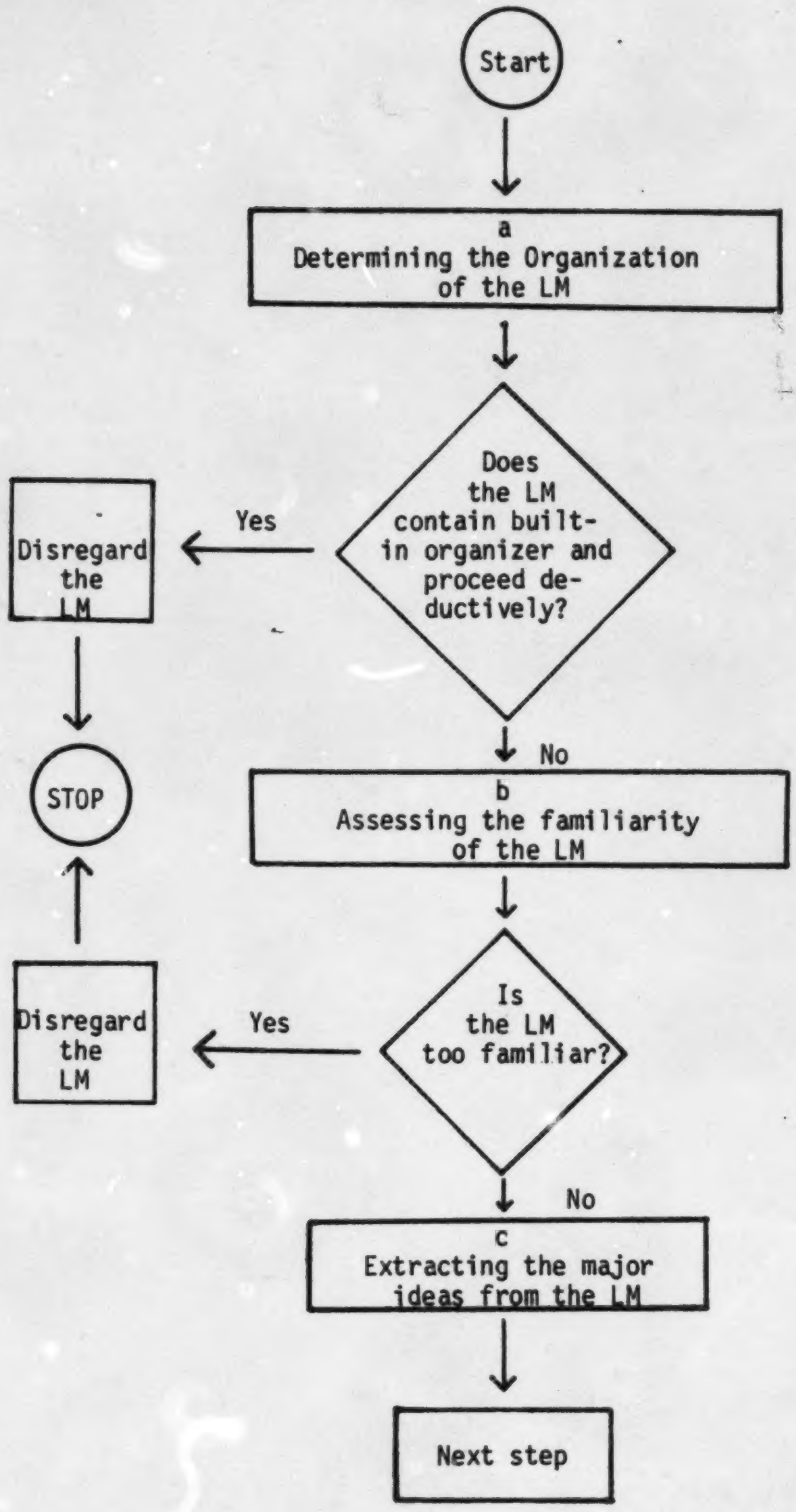

Figure 2: Flow chart analysis of learning materials (LM).